

DETAILED ACTION

1. This is the first action on the merits in response to the Claims submitted on March 31, 2009.

Drawings

2. The drawings are objected to because many features of the drawings are labeled in a language other than English. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

3. The claims are objected to because they include reference characters which are not enclosed within parentheses.

Reference characters corresponding to elements recited in the detailed description of the drawings and used in conjunction with the recitation of the same element or group of elements in the claims should be enclosed within parentheses so as to avoid confusion with other numbers or characters which may appear in the claims. See MPEP § 608.01(m).

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 3 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the use of the phrase "consists of" in Line 1 omits essential structure of the web cutter as disclosed by Applicant in the instant specification. The Examiner presumes "consists of" will be replaced by --comprises--.

Claim Rejections - 35 USC § 102 / Claim Rejections - 35 USC § 103

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

Art Unit: 1791

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

9. It has been held that where the claimed and prior art products are identical or substantially identical in structure or are produced by identical or a substantially identical process, a *prima facie* case of either anticipation or obviousness will be considered to have been established over functional limitations that stem from the claimed structure. *In re Best*, 195 USPQ 430, 433 (CCPA 1977), *In re Spada*, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). The ***prima facie*** case can be rebutted by evidence showing that the prior art products do not necessarily possess the characteristics of the claimed products. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

10. Claims 1 and 7 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Scardino et al. (US 6,308,509 B1).

11. Regarding Claims 1 and 7, Scardino et al. teach (in Figure 1 and in Column 2 Line 43 – Column 3 Line 22) a process of preparing a continuous filament composed of nanofibers, wherein

- a polymer spinning liquid is electrospun horizontally to a collector ("spinning tube 14") through nozzles to obtain a nanofiber web of ribbon form,
- then the nanofiber web is passed through an air twister and twisted to obtain a nanofiber filament of a continuous filament form ("twist and entanglement is imparted to the yarn by this [Air Vortex Spinning] mechanism"), and
- then the nanofiber filament is drawn ("drawn off in the form of yarn 19 on a take up roll 21").

In the alternative that Scardino et al. does not use multiple nozzles, Examiner notes that it is well-known in the electrospinning arts to eject material from multiple nozzles to increase the production rate of nanofibers, and that it would therefore have been obvious to a person having ordinary skill in the art at the time of the invention to use multiple nozzles to achieve that benefit.

12. Claims 1, 6-7, and 9-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (US 2005/0253305 A1) in view of Hasegawa et al. (US 4,424,611 A).

The applied Kim et al. reference has a common assignee with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

13. Regarding Claims 1, 6-7, and 9-12, Kim et al. teach a process of preparing a continuous filament composed of nanofibers, wherein

- a polymer spinning liquid is electrospun downward to a collector through nozzles to obtain a nanofiber web of ribbon form ([0016] and Figures 1-3),
- wherein the collector is coated with a nanofiber web separating solution comprising water or ethanol ([0016] and [0042]),

- then the nanofiber web is passed through a twister and twisted to obtain a nanofiber filament of a continuous filament form [0024], and
- then the nanofiber filament is drawn ("wound" [0024]).

However, Kim et al. do not teach that the twisting process is an air twisting process or the drawing is done between two rollers by using a gap in rotation linear velocity between the rollers.

In analogous art pertaining to filament preparation, Hasegawa et al. teach that an air twister is provided with a fiber passage and an air outlet formed at the center along the longitudinal direction of the fiber passage (the passage traced between fleece S and bundled yarn T that is drawn between two rollers by using a gap in rotation linear velocity between the rollers 5 in Figure 6) and an air inlet (Figure 6 Items P, 43, and 44) formed in a direction perpendicular or inclined to the air outlet for the benefit of providing a swirling air stream having an axial force component (as per Column 10 Lines 30-34).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to apply Hasegawa et al. to Kim et al. for the benefit of providing a swirling air stream having an axial force component.

14. Regarding Claim 13, Kim et al. teaches twisting two kinds of filaments together for the benefit of producing a hybrid nanofiber filament [0029].

Thus the previous combination discloses the claimed invention except for obtaining more than two kinds of nanofiber webs of ribbon form by electrostatically

spinning more than two kinds of spinning liquids, then passing the more than two webs through one air twister (i.e. the duplication web production prior to twisting).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to produce and twist more than two nanofiber webs of ribbon form as claimed, since it has been held that a mere duplication of working parts of a device involves only routine skill in the art. One would have been motivated to do so for the benefit of producing a hybrid nanofiber.

15. Regarding Claim 14, Kim et al. teaches drying (i.e. heat treating) drawn fibers for the benefit of removing residual water or organic solvent from the drawn fibers [0024].

Thus, while the hypothetical combination does not expressly teach heat treating fibers that have been both heat treated and twisted, it would have been obvious to a person having ordinary skill in art at the time of invention to do so for the benefit of removing residual water or organic solvent from the drawn and twisted fibers.

16. Claims 4 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (US 2005/0253305 A1) in view of Hasegawa et al. (US 4,424,611 A) as applied to Claim 1 above, and further in view of Chu et al. (US 2002/0175449 A1).

17. Regarding Claims 4 and 8, the previous combination teaches the general method as applied above, but does not teach that the nanofiber web of ribbon form is obtained by electrospinning in narrow sections in a manner the width of the nanofiber web is the same as the width of one nozzle block and that a nanofiber web separating film or a

nonwoven fabric is continuously fed onto the surface of the collector where nanofibers are electrostatically spun.

In analogous art pertaining to electrospinning, Chu et al. teach that a nanofiber web of ribbon form is obtained by electrospinning in narrow sections in a manner the width of the nanofiber web is the same as the width of one nozzle block and that a nanofiber web separating film or a nonwoven fabric is continuously fed onto the surface of the collector where nanofibers are electrostatically spun (see Figure 8 where webs in ribbon form are formed by spinnerets/nozzles 6 and are deposited and where a film/fabric 3 is continuously fed onto the surface of collector 9) and that such a method produces the predictable result of conveying electrospun material to post-spinning processors.

Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to apply the above-described portions of Chu et al. to the previous combination to achieve the predictable result of conveying electrospun material to an air twisting post-spinning process.

18. Claims 2-3 and Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kim et al. (US 2005/0253305 A1) in view of Hasegawa et al. (US 4,424,611 A) as applied to Claim 1 above, further in view of Chu et al. (US 2002/0175449 A1), and still further in view of Port et al. (US 3,398,220 A). Additionally, Claim 5 is rejected by these same references as applied to Claim 4 above.

19. Regarding Claims 2 and 3, the previous combination teaches the general method as applied above, but is silent on whether the nanofiber web of ribbon form is obtained by electrospinning in a manner that the width of the nanofiber web is the same as the overall width of the collector.

In analogous art pertaining to electrospinning, Chu et al. teach electrospinning to the edges of a collecting web (Figure 8) for the benefit of maximizing what is captured by a collecting surface. Therefore, it would have been obvious to one having ordinary skill in the art at the time of the invention to make the width of the nanofiber web is the same as the overall width of the collector for the benefit of maximizing what is captured by a collecting surface.

However, this hypothetical combination does not teach then cutting the nanofiber web by a web cutter comprising a rotary blade and a motor.

In analogous art pertaining to multifilament fiber production, Port et al. teach slitting a web of material to form multiple ribbons of material with a slitter mechanism comprising a rotary web cutter 15, then performing post processing on multifilament ribbons in texturing mechanisms 17 for the benefit of forming fibers in an uninterrupted series of steps, thereby increasing processing speed (see the Figure and also Column 3 Lines 8-24).

Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to apply a rotary web cutter like that of Port et al. to the

previous combination 17 for the benefit of forming filaments in an uninterrupted series of steps, thereby increasing processing speed.

The Examiner notes that while Port et al. do not disclose that the web cutter comprises a motor, the motion of the web cutter must inherently be provided by a motor driving at least the overall web conveying process, and thus in at least this broad sense, the applied rotary web cutter would comprise a motor.

20. Regarding Claims 2-3 and 4-5, in the case where the spinnerets/nozzles of Chu et al. do not each form discrete ribbons of nanofiber webs to be twisted, Chu et al. teach that the collection of nozzles/spinnerets form a nanofiber web of ribbon form that is the same width as a collector for the benefit of maximizing use of the collector surface, and while the previous combination does not teach cutting the nanofiber web with a web cutter comprising a rotary blade and a motor rotating the rotary blade, it would have been obvious to a person having ordinary skill in the art at the time of the invention to apply a web cutter as per Port et al. to the previous combination for the benefit of providing multiple streams of ribbon material that can be twisted in parallel, thus increasing overall processing speed.

21. Specifically regarding Claim 5 as applied to the first rejection of Claim 4 above, in the case where the spinners/nozzles of Chu et al. do in fact form discrete ribbons of nanofiber webs to be twisted, and while the previous combination does not expressly

teach placing barriers on a collecting surface spaced apart at the same distances the nozzle blocks are spaced apart, it would have been obvious to the skilled artisan to install barriers at such dimensions on the collector to prevent the discrete ribbons from each respective nozzle from becoming entangled for the benefit of proceeding to a cutting step like that of Port et al. without the need for a separate web cutter.

22. Claims 1-8 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (US 2002/0175449 A1) in view of Port et al. (US 3,398,220 A), and in further view of Hasegawa et al. (US 4,424,611 A).

23. Regarding Claims 1-8 and 12, Chu et al. teach a process of electrospinning wherein a polymer spinning liquid is electrospun horizontally to a collector, that has a film/fabric running thereon, through nozzles to obtain a nanofiber web of ribbon form which is post-processed (Figure 8 and as applied above).

However, Chu et al. do not teach that the web is slit into ribbons that are twisted.

In analogous art pertaining to multifilament fiber production, Port et al. teaches such a process to achieve the benefits described above, and it would have been obvious to a skilled artisan to apply those portions of Port et al.'s process to Chu et al. to achieve those benefits, regardless of whether such a process would be applied to slit a ribbon the width of the collector, or such a process would be applied to act as a barrier and slit any entanglements that formed between narrowly-deposited ribbons.

Additionally, the Examiner notes that in light of the combined teachings of Chu et al. and and Port et al, each of these two ribbon-width scenarios are considered to be obvious variants of each other.

However, this hypothetical combination does not teach that the twisting is done by air twisting followed by a drawing step.

In analogous art pertaining to multifilament fiber production, Hasegawa teach air twisting to achieve the benefits as described above, and it would have been obvious to a skilled artisan to apply the air twisting of Hasegawa's process to the previous combination to achieve those benefits.

24. Claims 9-11 and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (US 2002/0175449 A1) in view of Port et al. (US 3,398,220 A), in further view of Hasegawa et al. (US 4,424,611 A) as applied to Claim 1 above, and in still further view of Kim et al. (US 2005/0253305 A1).

25. Regarding Claim 9-11 and 13-14, while the previous combination does not teach the subject matter claimed therein, Kim et al. teach the claimed subject matter, as applied above and for the further benefit of enhancing coagulation of the nanofibers.

26. Therefore, it would have been obvious to a person having ordinary skill in the art at the time of the invention to apply Kim et al. to the previous combination for the reasons applied above, and for the further benefit of enhancing coagulation of the nanofibers

27. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (US 2002/0175449 A1) in view of Port et al. (US 3,398,220 A), in further view of Hasegawa et al. (US 4,424,611 A) as applied to Claim 1 above, and in still further view of Lee et al. (US 2002/0100725 A1).

Regarding Claim 13, while the previous combination does not teach forming hybrid, Lee et al. teach, in analogous art pertaining to spinning, that different electrospinning nozzles can be supplied with different polymer solutions to form a web with advantageous hybrid properties. Therefore, it would have been obvious to a person having ordinary skill in art at the time of the invention to apply Lee et al. to the previous combination resulting in spinning more than two kinds of spinning liquids and yielding more than two kinds of nanofiber webs of ribbon form, then passing the multiple ribbons through one air twister to form hybrid nanofiber filaments with advantageous hybrid properties.

28. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al. (US 2002/0175449 A1) in view of Port et al. (US 3,398,220 A), in further view of Hasegawa et al. (US 4,424,611 A) as applied to Claim 1 above, and in still further view of Ise et al. (US 6,319,601 B1).

Regarding Claim 14, while the previous combination does not teach applying a heat treatment to drawn fibers, Ise et al. teach, in analogous art pertaining to spinning, that applying a heat treatment to drawn fibers improves mechanical properties thereof.

Therefore, it would have been obvious to a person having ordinary skill in art at the time of the invention to apply a heat treatment as per *Ise et al.* to the drawn filaments of the hypothetical combination for the benefit of improving mechanical properties.

Double Patenting

29. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to

be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

30. Claims 1, 6-7, and 9-14 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-10 of U.S. Patent No. 7,354,546 B2 in view of Hasegawa et al. (US 4,424,611 A). Claims 1-10 of '546 comprise both the teachings and deficiencies of Kim et al., as applied above. Hasegawa et al. teach that curing these deficiencies is conventional in the art, also as applied above.

31. Claims 2-5 and 8 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-10 of U.S. Patent No. 7,354,546 B2 in view of Hasegawa et al. (US 4,424,611 A) as applied to Claim 1 above, further in view of Chu et al. (US 2002/0175449 A1), and still further in view of Port et al. (US 3,398,220 A). While '546 does not claim the what the instant application claims in the aforementioned claims, the cited references teach that operating as claimed in Claims 2-5 and 8 is conventional in the art, as applied above.

Conclusion

32. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Carr et al. (US 2002/0064628 A1) cite slitting and twisting a web of material
- Reneker (US 6,520,425 B1) cite air twisting nanofibers
- Wust et al. (US 2004/0045270 A1) cite a general air twisting process

33. Any inquiry concerning this communication or earlier communications from the examiner should be directed to RYAN OCHYLSKI whose telephone number is 571-270-7009. The examiner can normally be reached on Monday through Thursday and every other Friday from 9:00-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Del Sole can be reached on 571-272-1130. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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